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FOOD DIGEST

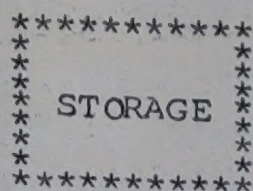
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NATIONAL INFORMATION CENTRE FOR FOOD SCIENCE & TECHNOLOGY
AT
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MYSORE 570 013, INDIA

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103 Rice bin for rural farmers

A trial rice bin made of reinforced cement mortar was built in Bangkok, using husk as the internal mold. The construction started by building an embankment of compacted earth about 60 cm. above the ground. A layer of coarse sand 10 cm. above the embankment is added to stop capillary water. The unreinforced base plate is cast using cement mortar and a ring beam is provided along the circumference of the base. The base plate and ring beam were cured by keeping water in the base for 3 days. After the curing period, a pile of paddy husk is placed on the base and a conical mold is formed by wetting and damping the husk into shape. In the absence of paddy husk, sawdust or sand can be used as mold. The mold is sprayed with water just before plastering. The mortar used for the wall is of the same mix proportion as used in the base. The plastering of the wall is done in two layers, each layer being approximately 1 cm. thick. The plastering operation started from the base to the top. The thickness of the wall is measured by piercing the wet wall with a small piece of wire. After plastering and before the mortar sets initially, the top of the bin is cut about 15 cm. from the top. The upper lid is used as cover of the bin. A rectangular opening is also made near the base for unloading the rice paddy. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.29; 1977; 31)

104 Simple improvements to traditional granaries

The traditional granary can be improved by thoroughly plastering the basket with mud stabilized with locally available 'pottery' clays, by providing a wooden or mud-plastered basketwork lid which can be firmly plastered in place once the granary is filled, and by providing an insect proof emptying spout made from bamboo "pipe" securely closed with a close fitting wooden plug. The granary can be rat-proofed by fitting conical rat guards made from beaten-out tins, or mud plastered basketwork-to the legs of the supporting platform.

(Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay, No.30; 1978; 25)

105 Pepper as an insecticide

Black pepper may have other uses - possibly as an insecticide to protect stored food products. Dr. Helen Su, from Georgia reports that treatment with ground black pepper and its alcohol extract was highly toxic to both the rice weevil and the cowpea weevil. (Journal of the American Dietetic Association. 71(3); 1977; 247)

106 Insecticidal properties of clay minerals

The insecticidal properties of certain clay minerals found in the country open up the possibilities of evolving a cheap method of protecting foodgrains and seeds against storage pests. Several inert dusts like attapulgate, bentonite, kaolinite and silicious earth collected from various parts of the country were tested for their insecticidal action against common storage pests. Adult insects

were exposed to inert dusts and their mortality was counted after every 24 hours. Of all the inert dusts, attapulгите from Marepally in Andhra Pradesh registered maximum mortality in a majority of storage pests in 72 hours.

On this basis, attapulгите dust was used to treat seeds and grains like wheat, jowar and gram and kept over a year. Surface dusting of bags containing wheat and jowar was also tried. The trials showed that a combination of direct mixing of attapulгите powder with seeds and dusting over the bags could ensure protection for one season. The surplus seeds could be washed and consumed without danger to health. Regarding foodgrains, the bags could be treated; but the grains coated with the powder might not be acceptable to the consumers.

The cost of treating one quintal of seed or bag with attapulгите powder is estimated to be not more than 50 paise. However, the methods could be useful only for the drier parts of the country since in humid conditions inert dusts become ineffective by absorbing moisture. (Financial Express. 17(240); 1977; 3)

107 Food storage projects

The International Development Association (IDA), will provide \$107 million credit to India for the second foodgrain storage project being implemented at an estimated cost of over Rs.194 crore. The project, designed to increase the country's foodgrain storage capacity and improve grain distribution, includes the construction of about 3.5 million tonnes of additional grain storage capacity in 16 states, provision of six rural grain procurement

centres, training management staff and technical assistance. It is scheduled to be completed in 1981. The project is the second operation for IDA in support of India's efforts to build additional storage capacity. (Yojana. 22(3); 1978; 40)

108 Controlling rodents

Rodent and insect control can be achieved using Nature-Shield. The unit modulates the magnetic field within the rodent and insect's environment causing stress. Under stress, the creature produces chemicals that cause disorientation, dehydration and death. This controls rats, mice, ground squirrels, termites and certain species of ants. Control is established within seven days to six weeks, depending on the kind of creature and the particular environmental conditions. The disc-shaped unit can be used indoors or outside and does not affect plant personnel. The battery-operated unit can control 30 acres. (Canner/Packer. 146(1); 1977; 95)

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*  FOOD ADDITIVES                   *  
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109 Two thousand times sweeter than sugar

A sweetener developed in Israel is awaiting clearance from the USFDA for use as an alternative to saccharin and cyclamates. Known as Neo-DHC and produced from naringin extracted from waste grapefruit peel, the sweetener, is claimed to be six times sweeter than sugar and is stated to contain

no joules.

Toxicological testings have not revealed any harmful effects. Neo-DHC is reported to have a distinctive after-taste, some say like menthol and others like licorice, and initial food applications are likely to be in confectionery and soft drinks. (Food Manufacture. 52(10); 1977; 22)

110 Saccharin's carcinogenicity

The Congressional Office of Technology Assessment (OTA) released a final report (early November) confirming the carcinogenicity of saccharin. The report concludes that laboratory evidence demonstrates saccharin as "a potential cause of cancer in humans", although it is "among the weakest carcinogens ever detected".

The report, "Cancer Testing Technology and Saccharin", further states that reliable estimates of how many people might get cancer from using saccharin, or where those cancers might be located, cannot now be made. The report does conclude that current testing methods "can predict that a particular substance is likely to cause cancer in humans". (Food Product Development. 11(10); 1977; 26)

111 Xylitol and cancer in male mice

The Huntington Research Center near London, tested the effects of xylitol on animals. The preliminary study results link xylitol with cancer.

Malignant tumors appeared in eight male mice and benign tumors in another eight males (out of 200) fed very high doses of xylitol. There also

was some thickening of tissue and stones in the urinary tract. (Food Product Development. 11(10); 1977; 26)

112 Butter flavorings improve taste, texture

Edlong Chemical Co., introduces butter flavorings containing multiphase suspension of lipolized butter-fat, natural butter acids, natural butter esters, and FDA-approved additives. Ingredients are dispersible in both water and hydrogenated fat and do not require refrigeration. (Food Product Development. 11(9); 1977; 66)

113 BP Chemicals publish new food preservative technigram

BP Chemicals have now published a Technigram giving details on Soprodac, a new food preservative introduced for specific use in preventing mould and rope-forming bacteria in bread.

Soprodac has been formulated as a less expensive yet more effective alternative to other bread preservatives, especially calcium propionate. (Food Trade Review. 47(11); 1977; 668)

114 Cocoa extender line

Four extenders for cocoa powder offer significant savings to food processors. Ingredients replace 50 per cent or more of the cocoa powder normally used in food products on a pound for pound basis with no change in storage, handling, or processing procedures. These products contain modified food starch, soy flour, soybean oil, palm oil, and cottonseed oil. In addition, they contain arti-

ficial and natural flavorings and artificial coloring to provide color, flavor, and functional properties of natural and Dutched powders, respectively. (Food Product Development. 11(10); 1977; 52)

115 Bulking agent for high volume/low weight foods

A new bulking agent, with unusually low bulk density, 1/10 that of granulated sugar, is available from National Starch and Chemical Corporation. Bulking Agent BA-23-C is a free-flowing, white to off-white powder produced from specially processed tapioca dextrin. Agent has both good solubility and clarity properties. Because of its low bulk density, BA-23-C is ideal for applications in dry mix foods with low filling weight of active ingredients. These uses include dry mix puddings, soups, gravies and beverages. In addition, it may be used to replace lactose, malto dextrans and other common bulking agents. (Food Product Development. 11(9); 1977; 64)

116 Anti-botulism agent patented

A patent recently issued to G.D. Searle and Co., Skokie, Ill., may be of particular interest to those companies using nitrates in their meat products. The patent (No.4,048,202) relates to a group of materials occurring naturally in pumpkin seeds and other fruits. Specifically, it involves a group of 3-O-alkanoyglyceric acids and their salts which function as anti-microbial agents. Thus, they inhibit growth of bacteria such as Clostridium botulinum, Clostridium paraputrificum, Clostridium perfringens, and Bacillus subtilis. The agent therefore is a possible substitute for nitrates. In addition, it has surfactant properties allowing its use as an

emulsifier. (Food Product Development. 11(9);
1977; 85)

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117 Papain preparation

A stable, enzymatically active preparation from papaya latex is prepared by obtaining latex from green unripe papaya fruit or from other parts of the papaya plant. The latex is collected over a pre-determined quantity of ZnSO_4 , NaCl , CaCl_2 or active carbon. The collected latex is then dried at a temperature less than 40°C . The preparation collected over NaCl may be used for tenderizing the meat of animals, for which it is administered to the animal before it is slaughtered. When collected over MgO or CaCO_3 , the product may be administered to poultry to increase their weight. When collected over CaCl_2 it may be used for clotting milk during production of cheese; and when collected over ZnSO_4 , for preparing cosmetics. (Indian Journal of Nutrition and Dietetics. 14(12); 1977; 388)

118 Synthetic tartaric acid

A simplified process has been indigenously developed for production of synthetic DL (Racemic) tartaric acid on a small scale. It requires maleic anhydride as the main raw material, besides an oxidizing agent and a suitable catalyst. Built up area for plant and equipment is 200 sq.m. The plant capacity is 50 kg/day and yield 97% on the

basis of maleic anhydride consumed. (Invention Intelligence. 13(2); 1978; 74)

119 Technology for soluble FPC

The Instituto de Investigaciones Tecnológicas has developed and is offering a technology for preparing a soluble protein concentrate from lean fish and for using it in the formulation of milk substitutes and other foods for human consumption. This technology involves the following stages:

1. A tasteless, odourless protein is prepared from fish meat, using a modified and improved fish-paste process which includes an aqueous extraction stage.
2. The purified protein is made soluble by enzyme action controlled according to the functional properties required of the final product.
3. The concentrate is either spray-dried or used in formulas with other ingredients to produce milk substitutes, baby foods, baby milk, dietetic foods, etc., and then spray-dried.

"The technology", says UNIDO, "will be of particular interest to countries where animal protein is lacking in diets but opportunities exist for developing a relatively low-cost fishing industry". (Fishing News International. 16(11); 1977; 49)

120 Product profile for the manufacture of guar gum

The demand for guar gum, installed capacity and production in the organized sector, addresses of suppliers of units are given. The details of the manufacturing process is presented. The major equipment and machinery required are:

1. Two brush separators with 5 HP electric motor;
2. Pulverizer, V-Belt drive complete with Indian make totally enclosed fan cooled 1440 rpm;
3. Four elevators 4" bucket 24' long;
4. Cyclone blower 4.6' dia and 10'6" long;
5. Shellar;
6. Two round sieve machines;
7. Drier complete with 1 HP motor;
8. Vibrating screens; and
9. Other accessories.

For a plant, manufacturing 1 tonne of guar gum per day in single shift (for one month) the capital outlay and personnel requirements are as follows:

Fixed capital investment on plant and machinery	...	Rs 1,40,000
Fixed capital on land and building	...	Rs 92,000
Working capital (3 months)	...	Rs 7,87,000
Personnel required	...	12
Return on total capital investment (before taxes)	...	25%

(Chemical & Polymer Times. 5(4); 1978; 8)

121 Concentration of egg white by ultrafiltration

The authors calculate that a return on capital investment of 35 to 40 per cent was possible by using ultrafiltration procedures for concentrating unpasteurized liquid egg white from 11.5 per cent solids to 23 per cent solids. The estimated cost of concentration based on a 10,000 pound per day operation over 250 days a year was 2.95 cents per pound of concentrate. Savings would be in shipping the liquid concentrate in tankers to drying facilities or to freezing plants.

The optimum operating pressure was about

in Orissa, which utilise rice bran, sal and other seeds of forest origin for extraction of fat. (Economic & Commercial News. 7(38); 1977; 9-10)

123 Carbohydrate waste

The plant set up uses the effluent waste with a high concentration of carbohydrates to convert into protein for use as animal feedstuffs. It is said to differ from most conventional effluent treatment processes in that it produces a valuable by-product in the form of a single cell protein (SCP). It comprises a balancing tank which receives flows discharged from the factory, followed by nutrient addition, pasteurization or sterilisation as required, prior to injection into a selected culture fermentation process under controlled pH and temperature conditions. The culture is said to rapidly convert the soluble substrate, reducing the chemical oxygen demand of the effluent for discharge. SCP is recovered from the effluent by separation and is then dried for use.

The process is expected to yield 3,000-4,000 metric tons of dried protein a year. The product is said to be of similar feed value to soyabean meal and other protein additives. (Baking Industries Journal. 10(5); 1977; 43)

124 Utilization of cattle feedlot (waste dung) and municipal refuse for SCP production

Most of the research work involved in the utilization of this waste for the production of single cell protein has been carried out at the laboratories of General Electric Company, U.S.A. Bellamy has shown that 9-48% of lignin, 29.75% of

cellulose and 60-75% of hemicellulose present in feedlot waste fibre is utilized by thermoactinomycetes for their growth. The cellular product obtained had protein content of 30-55%. The protein produced by the organism is found to contain high concentrations of lysine, tryptophane and sulphur amino acids. This product appeared to have high nutritive value for ruminants. According to the author the process for production of single cell protein appears to be commercially viable. (Cottage Industries. 9(12); 1977; 8)

125 Utilization of bagasse for SCP production

Work on the production of single cell protein from bagasse has been carried out extensively by Han and co-workers at Louisiana State University. Their process consists of grinding bagasse to above 1/8" size, slurring it with 2.4% sodium hydroxide, dewatering it, and partially oxidising the material with heat and molecular oxygen. The pretreated material is mixed with organic salts and is inoculated with bacteria belonging to cellulomonas (isolated from rotting bagasse). The authors found that a symbiotic fermentation with mixed cultures of cellulomonas and Alcaligenes gives better degradation of bagasse cellulose and higher protein content. The cells are harvested by acid precipitation of cellulose-free media, centrifuging and freeze or drum drying from the precipitated cream. Cells have been reported to have 58-62% crude protein and are low in fat, fibre and lignin (about 2% each) but have high ash content (7-9%). Feeding experiments on drum dried product caused an undesirable salt imbalance in rats, resulting in hydration and increasing water passage. Freeze dried product had

low ash content as well as low NPU values. (Cottage Industries. 9(12); 1977; 8)

126 Byproduct power of the sugar industry to augment rural electrification

Sugar factories are in a position to utilise surplus by-product power and feed it either in the grid or more particularly for electrifying the neighbouring villages. Most of the sugar factories in India can generate electric power and supply the surplus power to the neighbouring villages to augment rural electrification. (Proceedings of the Sixth Joint Convention of Sugar Technologists' Association of India. 1977; E1)

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127 High protein peanut flour

High protein food extender is the result of new processing technology which successfully eliminates tannin, requires no chemical additives, and effectively preserves rich peanut protein from denaturation and the flour can be blended with other foods upto 60 per cent without altering original flavour. This increases the nutritive value of many foods. It is used to replace many protein rich foods. (The Indian Journal of Nutrition and Dietetics. 14(6); 1977; 187-8)

128 Full fat, partially defatted, bland tasting peanut flours

A new processing technique for converting edible grade peanuts into either a full fat or partially defatted peanut flour has been demonstrated. Resulting flour can be used to modify taste, carry functional ingredients, or provide supplemental nutritive elements in a formulation. In addition to the fat variation, the basic nut can be roasted to differing degrees to alter flavor notes or color of the resulting flour.

A typical analysis of the flour shows 39.5% protein in the untoasted form and 42.1% when nuts are toasted. Fat content is 32.3 and 34.1%, respectively, for untoasted and toasted product, while moisture drops from 6.1 to 1.2 for untoasted vs toasted forms. Complete mineral, vitamin, amino acid profiles, and microbiological assay are provided. (Food Product Development. 11(9); 1977; 62)

129 Apple juice concentrate

Himachal Pradesh government has developed a '7-in-1' drink from apple. The process involves evaporating water from pure apple juice to reduce it to one-sixth of its volume. The resultant concentrate can be converted to pure apple juice by adding water six times. The plant, which is the first of its kind in the country, has a capacity to crush about 2,000 tonnes of apples in a season. The concentrate contains seven important food values, viz., sugar, sodium, potassium, calcium, protein, iron and vitamins A, B and C. (Industrial News Digest. 1(1); 1978; 24)

130 Egg drink

'Egg drink', is the new drink made out of milk, spices and eggs. Incidentally it is one of the top selling drinks in the United States. Mixed with a measure of brandy and heated, it is claimed to be an ideal winter night-cap. Chilled, the Egg Nog is a suitable drink in summer. (Poultry Guide. 15(1); 1978; 66)

131 Fat-free butter substitute

"Instabutter", which measures and tastes like melted butter will be available at a fraction of the cost and requires no refrigeration. To use, add hot tap water, stir, and use in lieu of melted butter on seafood, vegetables, or potatoes, may be used in dry form to add butter flavor. It has 94 per cent fewer calories and 99 per cent less cholesterol than butter. (Journal of the American Dietetics Association. 71(3); 1977; 304)

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132 Table type weighing machine

Crown, self and semi-self indicating machines are light, elegant and accurate. Self-indicating machine may be considered as an automatic weighing scale as it requires no loose weights during weighing. Semi-self indicating is semi-automatic, requiring no weights upto a certain load, but has an advantage of covering wider weighing capacities.

The range covered is 2-30 kg with 1 g or 5 g minimum chart division. High precision is achieved by using high-grade alloy steel knife edge and refined agate combination. Outside casing is finished with hammerable, oven-baked enamel paint, ensuring long life even under adverse environmental conditions. (Industrial Products Finder. 6(4); 1978; 64)

133 Winnower/Grain cleaner, hand operated

This machine is composed of a hopper fitted with a plate to regulate the flow of grain to a set of vibrating screens. These screens separate out and reject larger material. The grain and smaller materials fall through the screens and encounter the blast of air coming from the rotating ventilator. The grain falls on to the inclined screen while the dust and chaff is blown but through the opening onto pile. The screen vibrates back and forth so that the whole pieces of grain slide down particles fall through the screen and onto pile. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.28; 1977; 6)

134 Rice huller, Jawa hand-powered type

This small machine is intended for the grower of small quantities of rice paddy and for domestic use. It replaces the paddy pounder. Paddy can be shelled at a maximum rate of about 14 kg per hour, but the capacity may vary considerably depending on the type of paddy and its condition. The machine has three adjustments, controlling the feed, the discharge, and the hulling knife. A perforated plate allows dust to escape, and the machine can be opened easily for cleaning. Strongly made, it

weighs 10.5 kg net and is provided with mounting screws and spanners. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.28; 1977; 3)

135 Rice huller

This small hand huller is an all-metal construction, and is very sturdy. The gearing arrangement permits the internal rollers to run 3500 to 4000 r.p.m. Paddy is instantly hulled, regardless of size and shape, causing no damage to the grains. Output capacity of this machine is approximately 250 kg of paddy rice per hour with 90 per cent or more hulling efficiency. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.28; 1977; 4)

136 Portable rice bran stabilizer

It is a hand operated stabilizer. This low cost device is ideally suited for small to medium scale rice mills. It consists of a drum made of galvanised iron sheet. It revolves on a hand operated lever. Beneath the drum is perforated sheet for direct heating with firewood, charcoal, rice husk, or groundnut shells. The drum has a feeding door and a hole for fixing a thermometer. At one end, a vent is provided for the escape of steam and gases. The capacity of the unit is 10 kg of bran per batch.

Fresh rice bran is heated in the rotating drum for 30 to 60 min. at 90 to 105°C. The stabilised bran is then discharged through the feeding door and the hot bran is allowed to cool in open air. The free fatty acid content (FFA) of the

stabilised bran rose from the initial 2 to 4% only in seven days whereas in unstabilised bran it rose to 20%. Storage for a month did not show any change in FFA content. The oil extracted from stabilised bran can be refined and bleached by conventional methods. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.30; 1978; 1)

137 Grain roller

This hand operated machine is used for flattening grain into flaky, non-fragmented feed. Two people are required to operate the opposing cranks. These cranks turn conical rollers to flatten the grain. One of the rollers is spring loaded so that its position can shift along the shaft in order to avoid damage due to hard foreign objectives. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.28; 1977; 2)

138 Breaking eggs with air

A Rotary vane air compressor is being used to power an egg breaking and separating machine at Edinburgh firm. As the eggs are broken, reverse jets of air from the compressor blow residual white of the egg out of the unwanted shells which are then air-ejected from the machine. A third jet of air flows across the stream warning operators of the presence of sub-standard eggs. (Baking Industries Journal. 10(5); 1977; 44)

139 Pellet mill

Pellet mill Type PS-300 consists of a vertical ring die with radial holes held by a holder, wearing ring and front die cover. Two press rolls

with an eccentric shaft are held stationary by a roller holder shaft. Dynamically-balanced drive pulley for the die is driven by an electric motor and V belt drive. A unique shear pin with micro-switch avoids cracking of the die or rolls in case of overload. Swinging front door can be opened in minutes for maintenance of vital components. Adjustable cutting knives can be set to cut pellets of the desired size. Inspection windows on the door and the body show the performance of the process while the mill is in operation. Also fitted are SS feeder conditioners with paddle conveyor and steam mixing chamber, mechanical spread variator conditioner, tacho generator with RPM indicator, steam valve and magnetic separator. The mill is used in animal feed plants, as well as groundnut oil mills to pelletize cattle and poultry feeds, oil and de-oiled cakes, brans, groundnut husk, etc. It can also be used to pelletize tapioca powder starch, chemicals and detergent. (Industrial Products Finder. 6(5); 1978; 69)

140 Instrument checks temperatures during canning

Thermophil-K is specifically designed for measuring and monitoring the temperature of foods inside containers during preservation or pasteurization. Measured values are indicated on an analog meter. An acoustic signal emitted at intervals of 1 min ensures regular checking of the preset temperature over a predetermined period of time. This is an important factor for both shelf life and taste of the processed product. The system comprises a variety of sensors for use with cans, bags, cups or pouches as well as transmitters, indicators and multi-point recorders. It can also be expanded

to include an F-value computer. (Food Engineering. 2(10); 1977; 69)

141 Instrument for determining inside temperature of foods

A precision instrument system has been designed for obtaining the internal core temperature of canned foods during processing. It has adaptations of the system to freezing, dehydration, baking, confectionery and other branches of the industry. (Food Engineering International. 2(9); 1977; 80)

142 Steam distillation plant

Regional Research Laboratory, Bhubaneswar, has developed a steam distillation unit, wherein essential oils can be recovered from essential oil bearing plants. In this unit, after distillation, waste material is replaced by fresh stock without much loss of heat and time. Such units are specifically suited to operate under conditions prevalent at raw material sites, utilising readily available fuels such as firewood. The process maintains the quality of the oil comparable to ideal laboratory standards by keeping the charge and oil away from high temperature contacts. (Industrial Products Finder. 6(2); 1977; 56)

143 Fruit juice concentration plant

Flexibility is the key feature of this combined flavour recovery and concentration equipment. Suitable for processing apple, pear, stone-fruit juice, etc. as well as grape and berry juice, the plant can be used for a variety of combined oper-

ations. For example, de-aromatization can be combined with pre-concentration or concentration of apple juice. In another arrangement, grape juice can be concentrated and de-sulphurized.

A significant advantage is that two processes or two different types of fruit juice can run in parallel. Depending on fruit juice and process, output varies from 1375 kg/h for de-aromatization and concentration of berry juice to 314 kg/h for final concentration of clear apple juice. (Food Engineering. 2(10); 1977; 95)

144 Continuous air blast freezer for quick frozen foods

A prototype continuous air blast freezer has been designed and built at Torry Research Station, Aberdeen, for the production of 200 kg/hour of individually quick frozen (IQF) fish fillets and other food products.

The Torry freezer has a conveyor belt of plain stainless steel sheet which makes it suitable for the freezing of products which would otherwise adhere to open mesh or link belts and make them difficult to remove when frozen, and it can also be washed and wiped dry on its return to the loading position so that a high standard of hygiene can be maintained during operation. Another advantage of the plain belt is that the frozen product is not imprinted with a belt pattern.

The prototype freezer has proved satisfactory in trials with a number of products and it can be operated continuously for 22 hours without defrosting. (Food Processing Industry. 46(552); 1977; 9)

145 Mixing machine

This machine is for mixing foodstuffs (particularly bakery items) and chemicals in pharmaceutical industries. The machine is suitable for mixing dry, wet as well as viscous material giving thoroughly mixed endproduct. It comprises a stainless steel drum (it can be made of other material) within which a specially designed mixing element is made to rotate on ball bearings. These mixing elements, rotated at specific speeds, perform the mixing process. The mixing machine is driven by a suitable electric motor. It is mounted on a sturdy steel stand and equipped with safety guards. The mixing drum is made tiltable. Suitable gears are provided to rotate the mixing element at specific speeds. The mounting and motor are enclosed in a suitable cabinet. (Industrial Products Finder. 6(6); 1978; 72)

146 Vertical mixer

Mix Well is a streamlined mixer suitable for dry mixing. Feeding and discharge are at the ground level. It works on the principle of whirlwind. Ingredients are continuously lifted to the top by a screw conveyer or from where they are thrown to the sides of the walls. They are again lifted and the process continues, to give within minutes a homogeneous mix. (Industrial Products Finder. 5(12); 56)

147 Vacuum mixing and homogenizing machines

The Multi-Homo vacuum mixing and homogenizing machine has been specially developed for clean,

aseptic and sterile working. All parts in contact with the product are in high-gloss, polished stainless steel. Important features include a heatable and coolable vessel with double jacket and a mixing system comprising a high-speed turbine homogenizer; as well as an anchor-shaped agitator and a counter-rotating spiral mixer. In addition, a cover is provided for working under pressure and vacuum, which is also fitted with a sight glass, a wiper and a lamp. The Super-Duomixer is suitable for pharmaceutical, cosmetic and food processing firms, available in 50, 100, 200, 300, 500 and 1,000 litre working capacity. Also available is a Homo-Rex turbine homogenizer (rotor/stator principle), model 7-Hr with a mobile lifting stand and vessel. (Industrial Products Finder. 5(12); 1977; 55)

148 Solar rice dryer

Asian Institute of Technology (AIT), Bangkok, has recently developed and successfully tested a low cost solar rice dryer, which will enable rapid drying of rice grains in the wet season. The prototype unit consists of: (i) a 1-m^2 flat bed batch dryer made of wood and plywood, covered by a plastic sheet; (ii) a mosquito-net which serves as the perforated floor of this dryer; and (iii) a 3-m^2 simple solar collector, made of burnt rice husk spread on a sloping earth surface and covered by a plastic sheet for protection against rainfall. The system functions by natural convection which heats up the ambient air flowing through the sloping solar collecting surface to a temperature of $40^\circ\text{-}45^\circ\text{C}$. This heated air enters the batch drying house containing paddy grains of varying depths. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.30; 1978; 21-22)

This dryer is designed to hold 1.25 tonnes of wet paddy. It could be used at village level by a small rice miller or by a farmer or group of farmers. It has two concentric circular cylinders made of 2mm (5/64) dia. perforated mild steel sheet of 20 gauge. Inside cylinder is 80 cm dia and 150 cm height. Outside cylinder is 135 cm dia and 225 cm height. These two cylinders are supported in 4 channel sections (100 x 45 x 3). The whole frame would be supported by a suitable foundation or may be bolted to a frame made of channel section (100 x 45 x 3). The weight of the frame with the channel section frame is 300 kg and the frame weight is 170 kg. A bucket elevator of 6.00 metres in height with 2.5 tonnes per hour capacity is used to load the paddy into the dryer. A centrifugal fan (85 cubic metres min and 5 cm. W.G. pressure) blow the hot air into the inside cylinder. The inside cylinder acts as a plenum chamber and the air from this goes out through the paddy and through the outside cylinder. A baby torch burner is used to supply the heat necessary with kerosene as fuel. Automisation of kerosene is done by blowing air taken from a small compressor at about 7 kg/cm^2 . Paddy is fed on top of the inside cylinder and it comes in contact with hot air while it is flowing downwards in between the two cylinders. Feed rate of paddy is controlled by closing or opening the gate provided to the discharge hopper of the dryer. Paddy is circulated till the moisture content drops down to 14 per cent. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.30; 1978; 36-37)

150 Drum dryer

Technical Products of Bombay manufacture drum dryers suitable for continuous drying of chemicals in slurry form. The slowly rotating drum which is steam heated picks up a film of slurry from a trough situated below it. The material is completely dried up by the time it reaches the scraper knife which scrapes it off. A spreader blade for accurate control of thickness of the film picked up by the drum and an agitator in the trough for keeping the slurry in continuous suspension are special features. The material of construction can be stainless steel or mild steel depending upon suitability. (Industrial Products Finder. 5(10); 1977; 64)

151 Fluid bed dryer

Spectoms Engineering, Gujarat, have introduced the fluid bed dryer for pharmaceutical, chemical, plastic, food and allied industries, said to ensure perfect drying within minutes. 4-door design ensures better sealing. Air control and exhaust air re-circulation flaps are for maximum thermal efficiency and minimum drying time. High efficiency fan directly coupled to the motor is designed for low operating noise level. Pressure relief panels (explosion doors) provide instantaneous release of positive pressure with maximum relief areas. Conveniently located container sight glasses provide a view of the product fluidization. Low container trolley avoids lifting of the container to inconvenient heights. Illuminated filter bag compartment is for instantaneous detection of ruptured filter bags. (Industrial Products Finder. 6(4); 1978; 33)

152 Solar drier for drying of fish

The solar drier for drying fish and fishery products comprises means for heating air by solar radiation and an air blower for blowing the heated air through a tunnel provided with drier arrangement for holding aluminium trays. The drier is simple in construction and is particularly suitable for use in tropical regions. The fish can be dried at 45°C, average temperature within 13-15 daylight hours to 20-25% moisture level. The cost of fabrication of a 50 kg. capacity unit works out to Rs.6,000/-. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.28; 1977; 30)

153 A polythene tent drier for improved sun drying of fish

Tests were carried out in Bangladesh to dry fish using polythene (150 μ m thick) sheeting on a bamboo frame of 2m x 2.6m dimension. The drier proved successful in killing fly larvae and adult flies. Temperatures in excess of 45°C were attained for a total of 9.5 hour over the first 3 days of drying when the outside temperature was 27°C.

The three split Kamila fish were dried to the required level in 3 days and were at no stage infested, although dead flies were observed on the floor of the drier. The sketch of the polythene test drier alongwith bamboo frame is given. (Food Technology in Australia. 29(11); 1977; 437)

154 Batch dryer for paddy

The International Rice Research Institute has developed a small batch-type grain dryer for

farm-level operation in South-East Asia. This dryer can be locally manufactured in small machine shops in most developing countries. It consists of a rectangular bin with a perforated floor beneath which is a plenum chamber. An axial flow fan inside a circular housing, powered by an engine or an electric motor, is connected to the plenum chamber through a canvas duct. Two kinds of burners have been developed to heat the drying air, one for oil and the other for rice hulls. The dryer can dry 1 tonne of wet paddy grain in 4-6 hours, depending on the initial moisture content of the paddy. For such drying requirements, the fuel consumption is 0.75 litre/hour for the gasoline engine; 2.0 litres/hour for the kerosene burner; and 3-4 kg/hour of rice hull for the rice hull burner. The wasted heat from the engine can raise the air temperature by 6°C. The dryer has been well accepted by many Philippines farmers. Engineering drawings are available on request from IRRI, Philippines. (Research & Industry. 22(3); 1977; 215)

155 A simple village 'Solar Dryer'

This is a simple device using heat from the sun to preserve a large variety of foodstuffs. Food dried in this way can be stored easily, and lose little of their nutritious value or original flavour. Most fruit and vegetables can be dried ready for storage in one day. Meat and fish can also be preserved. A large rectangular mud and wattle drying box is built on a flat piece of ground in an East/West direction. Poles are attached to loosely woven mats to form drying trays and are fitted inside the box. A cover is made from a

large piece of polythene and any evaporated water is allowed to escape through plugs in the box. Fresh air is channeled through hollow bamboo or reed tubes under the drying trays. No particular skills are needed for its construction other than the ability to put up a low mud and wattle wall, and to take measurements. The dryer can be constructed in approximately 2 days by 2 men. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.29; 1977; 3)

156 Microwave cooking

Cooking the microwave way is the latest gadget electronic engineers have to offer to reduce the housewife's drudgedy.

The State-owned Electronics Corporation of India Limited (ECIL) has developed a 'microwave oven', the first of its kind in the country.

The 30-litre capacity oven is fast, hygienic and economical; the power consumption per hour is two units of electricity and is capable of cooking food for a family of four in an hour.

The sleek-looking oven is fitted with two timers, a glass broiler tray and two heat resistant ceramic skillets.

The oven costs Rs.5,000 and only heats up the food and not the container, thereby eliminating sticking of food. (Financial Express. 18(103); 1978; 5)

157 Solar steam cooker

This consists of an inclined insulated box in which one or more metal pipes, containing water,

are thermally attached to a black painted metal sheet. Two layers of transparent covering material are placed over the front of the collector box. Upon exposure to the sun, the water in the pipes heats upto the boiling point and steam is generated. This steam rises through a header pipe to an insulated steam chamber where it condenses on the sides and bottom of a cooking vessel, thereby heating the food inside. Cooking times are about 30% longer than when traditional fuels are used. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.28; 1977; 5)

158 Solar steam cooker

This can be used for cooking slow-cooking foods, like maize, beans, potatoes, etc. It can also be adapted for large scale cooking in schools and institutions. This works slowly all day in the sun to produce a cooked meal in the evening. It consists of a long pipe to which a metal plate is fixed in order to gather heat from the sun. The pipe is closed at the lower end, and is bent up to pass into a large aluminium cooking vessel. The vessel is covered with any convenient material to prevent heat loss eg. pith from sisal, papyrus, grass, leaves, newspaper etc. The pipe and plate are also insulated inside a box which has a polythene top to allow sunlight in. Cooking pots are placed on stones inside the cooking vessel, approximately $\frac{1}{2}$ pint of water is added and the lid put on. The water flows down the pipe and is heated by the sun to form steam which cooks the food. Only pure water (rain water) should be used, otherwise the cooker can become blocked with deposits. The cooker should be covered when not in use. All the necessary

materials can be obtained from hardware shops.
(Documentation Bulletin, Vaikunthbhai Mehta Smarak
Trust, Bombay. No.29; 1977; 4)

159 Smokeless domestic oven

Smokeless, regenerative, high efficiency domestic oven, has been developed by the Central Mechanical Engineering Research Institute, Durgapur.

The oven consists of a cylindrical core chamber with an annular chamber around it. The annular chamber is closed at the bottom and has a removable top cover. During normal cooking, coal fines are kept in the annular chamber which, beside providing insulation, acts as a regenerator by utilizing a portion of the heat energy (normally lost in conventional domestic ovens) to produce coke for subsequent burning in the core chamber as smokeless fuel.

The core chamber is so shaped that it provides an efficient draft. It holds 1.5 kg of coke, while the annular chamber may contain 2 kg of coal fines. The oven's start up time is 18 min, duration of useful fire 170 min, and heat utilization capacity about 50%. Normally, a conventional oven of same capacity utilizes heat upto 35%, and gives useful fire for about 150 minutes.

The bare oven weighs about 5 kg. Its manufacturing cost is estimated at Rs.30. (Invention Intelligence. 13(1); 1978; 9)

160 Coconut cracker (dehusker)

of
The traditional method/cracking a coconut to separate its husk and shell is very primitive and

inefficient, even though today the Copra processing industry uses highly technical methods for other operations. A simple tool has been developed, which can crack approximately 100 to 200 coconuts per hour.

The coconut is struck manually against the close-toothed blades. Next the handle is turned around ^{and} the cam action snaps the coconut into two pieces. One or two subsequent operations are needed to separate the core completely. (Documentation Bulletin, Vaikunthbhai Mehta Smarak Trust, Bombay. No.28; 1977; 2)

161 Design and development of continuous Chhana making machine

The NDRI have developed a design for continuous production of Chhana on a large scale, and a semi-commercial plant with a capacity of 40 kg/hr chhana is being fabricated. Data concerning design, quality of the raw materials and characteristics of the product are studied. (Bulletin of Indian Raw Materials & Their Utilization. 4B(1); 1978; 22)

162 Combination foils for sensitive foods

Flexible combination foils which can be sterilised are recommended for the packaging of sensitive foodstuffs particularly for fresh meat cuts, sausage products and ready-to-eat dishes. They are combinations of layers of polyamide/polyethylene, metallised polyamide or polyester/polyethylene. The metallisation is carried out with aluminium in high vacuum. The thickness of the pure aluminium foil which is physiologically harmless ranges from 250 to 400 Angstrom units only. These foils provide almost total protection against visible and ultraviolet

light and possess reduced permeability for oxygen and water vapour. (Food Manufacture. 52(11); 1977; 90)

163 Can opener

This fully automatic machine opens cans, empties them, and reduces the empty cans to small scrap packages. Only one operator is needed; capacity is 500 cans/hour, it can be set to accommodate different can sizes.

After being fed by a conveyor belt through the opening station, the cans fall into a centrifugal basket. Centrifuge time is infinitely variable to suit the consistency of the product being emptied. Centrifuged material is discharged into a closed container while the empty cans are reduced to scrap by a small press.

Cans containing tomato pulp, fruit concentrates, applesauce and similar products can be handled. Residue is negligible, approximately 0.3%. (Food Engineering International. 2(9); 1977; 68)

164 Continuous heat sealer for plastic bags

Simplicity is the key feature of this continuously heat sealer. Specifically designed for all-plastic sealing, the machine operates on the hot air principle. Plastic bags or sacks of any type or size pass between hot air capsules virtually melting the plastic material at a predetermined, controlled temperature. The material is then knurled by two cold serrated wheels. Depending on the product to be packed sealing speed can be between 8 and 14 m/min. Applications include milk

powder, flour biscuits, pet foods, sugar and pre-packed farm products or frozen foods. (Food Engineering. 2(10); 1977; 69)

165 New closure meter to prevent fluid loss

To meet the widespread need in the food processing industry to prevent loss of fluids through loose or damaged bottle tops, a range of closure meters is now available. With the universal clamping device, which adapts easily to all shapes of container, the meters provide a reliable and accurate means of checking the tightening or untightening torque on closures fitted by automatic bottle capping machines. They can also be used to ensure correct tightness of closures on all types of plastics, glass and metal containers. The five basic models, each with a choice of several torque ranges, are suitable for left and right hand operation and are portable, so can be used on any horizontal surface. (Food Trade Review. 47(11); 1977; 674)

166 Polythene bag-making machine

A rotary polythene bag-making machine with an output of upto 1,400 bags per minute (2,800 bags per minute with optional web slitting equipment) and with web speeds up to 300 m/min, has been introduced recently. It is suitable for use with both high and low-density polythene and similar heat-sealable materials. (Cottage Industries. 9(8); 1977; 3)

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 ** FOOD ANALYSIS **
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167 A simple method for estimation of Thiamine

According to National Institute of Nutrition, Hyderabad, sea sand of 50-80 mesh obtained from Madras, India, has a satisfactory capacity to absorb thiamine, and the elution of the vitamin was quantitative. Results of comparative tests with several common cereals and legumes have proved that Madras sea sand is as good as the synthetic Zeolite Decalso as a base-exchange for the estimation of thiamine. The sand, like Decalso, can be reused a number of times after washing. (Indian Journal of Nutrition and Dietetics. 14(12); 1977; 388)

168 Estimation of mould contamination in tomato products by chemical method

The microscopic method for estimation of mould count in tomato and other fruit products is influenced by many factors including the species of mould, the degree of comminution or homogenization of the product, the degree of standardisation of the method and the expertise of the microscopist. To overcome this a chemical method involving the estimation of Chitin, a cell wall constituent of fungi, which is not found in higher plants has been developed for tomato juices and purees. Hydrolysis of the chitin yields a degradation product 'Chitosan' which can be quantitatively recovered and deaminated to give an aldehyde, 2,5-anhydromannose, which can be estimated colorimetrically.

Results with spiked samples showed recoveries better than 95% of the expected level of fungal glucosamine added. Comparison with the Howard Mould Count showed a high correlation. Correlation coefficient for non-homogenized juices and purees was observed, whereas it was a low correlation for homogenized juices. Further this method can be applied to cereals; However, insect contaminated samples give misleading results. (Journal of Food Technology. 12(6); 1977; 581)

169 Detection of adulterants in foods

Name of food articles	Adulterants used	Simple test to detect adulteration
Ghee or Butter	Vanaspati	Take about one teaspoonful of melted ghee or butter with equal quantity of hydrochloric acid in a test tube. Add to it, a pinch of cane sugar. Shake this well for a minute and let it stand for five minutes. If a crimson colour is seen in the lower part of the test tube, the ghee or butter is adulterated with vanaspati.
Milk	Water	The reading of the lacto-meter should not be less than 1.026. Put a drop of milk from the container on a polished vertical surface. If it flows slowly leaving white trail behind it or if it stands still, the milk can be considered unadulterated. The adulterated milk drop will flow immediately without leaving any mark.
	Starch	Add tincture of iodine to a small quantity of milk. If a blue colour shows up it can be surmised that starch has been added to the milk.

Edible oil	Argemone oil	Add concentrated nitric acid to the sample and shake carefully. Red to reddish brown colour in the acid layer would indicate the presence of argemone oil.
	Mineral oil	Take 2 ml of edible oil and add an equal quantity of N/2 alcoholic potash. Heat in a boiling water bath for about 15 minutes and add 10 ml of water. If there is any turbidity, it shows the presence of mineral oil.
	Castor oil	Dissolve some oil in petroleum ether in a test tube and cool it with ice-salt mixture. Presence of turbidity within 5 minutes indicates the presence of castor oil.
Sweetmeat Ice-cream Sharbat	Metanil-Yellow (a nonpermitted coaltar dye)	Add a few drops of concentrated hydrochloric acid. If magenta red colour develops, the presence of metanil yellow is indicated.
Turmeric	Metanil yellow	Take a teaspoonful of turmeric powder in a test tube. Add a few drops of concentrated hydrochloric acid. Instant appearance of violet colour, which disappears on diluting with water, shows the presence of turmeric. If the colour persists, metanil yellow (a non-permitted coaltar dye) is indicated.

(Times of India. 27-2-1978)

170 Detection of adulteration of edible oil with Jatropha oil

Recently there was a case of large scale food poisoning that occurred in Coimbatore City due to the consumption of groundnut oil adulterated with Jatropha oil i.e. Kattamanakku oil. The seed resembles castor

seed in shape but is smaller in size and is of dark brown colour. The seed kernel is rich in non-edible oil (46-58%). The seed possesses a toxic principle curcine and resinous substance which have strong nauseating and purgative action.

The seed oil is practically colourless and odourless when fresh. Only on standing, it acquires a pale yellow colour and a disagreeable odour. It has been used for adulteration. The oil has a characteristic ultra violet absorption spectrum with a peak absorption at 259 mμ. At this wave length, edible oils, like groundnut, sesame, coconut etc. exhibit no absorption. So an admixture of these oils with 0.5% of Jatropha oil could be detected easily from the absorbance values with the help of ultra violet spectrophotometer. Further, by thin layer chromatography, it has been found that only Jatropha oil gives a greenish yellow fluorescent spot at the origin. Even an addition of 0.5% of Jatropha oil could be easily detected. (Agriculture and Agro-Industries Journal. 10(11); 1977; 39)

171 Butter refractometer

Asco butter refractometer AS: 17750 is used for testing purity of ghee, butter, jam, sugar solutions and oils. Range of butter reading is from 0 to 100, and the range of refractive index is from 1.42 to 1.49. Range of sugar reading is from 50% to 85%. For maintaining constant temperature, provision is made for circulating water around the prisms. For achromatic border, compensating prism is provided. (Industrial Products Finder. 5(10); 1977; 45)

172 Measuring oil colour

A New British instrument measures refined edible oil colors automatically and gives its read-out in internationally-accepted Lovibond units.

The new Tintometer operates by measuring the optical density of the sample at two points in the spectrum, approximately equal to the colours of the Lovibond Tintometer red and yellow filters. A beam of light passes through the sample and through three interference filters on a wheel turning at 150 rpm. As each filter lines up with the light beam an appropriate amplifier is switched in electrically. (Food Processing Industry. 47(554); 1978; 47)

173 Automatic milk quality analyzer

Introduction of an automatic Milk Quality Analyzer, Model MQA-53, which determines the percent protein, milkfat, Vitamin A, lactose and two additional constituents (such as total solids) at speeds of upto 300 samples per hour has been announced by Neotec Instruments. The MQA-53 affords unsurpassed accuracy, reliability and ease of operation. (Food in Canada. 37(11); 1977; 52)

174 Titration indicator attachment

Veego (Bombay), titration indicator attachment Model VKF-3 is designed for use with normal titration outfits in laboratories for accurate indication of the end-point. It is suitable for potentiometric, Karl Fischer and oxidation-reduction titrations. The end-point is very clearly indicated by a sensitive magic eye detector. The equipment is to be coupled to the titration outfit by connecting the

electrodes to the sockets provided on the unit. The front panel consists of all necessary controls such as sensitivity, relay position, polarisation and on-off switches. Finished in chemical-resistant epoxy paint, the unit is compact in design and easy to operate. Other accessories such as electrodes, clamps, as well as beaker assembly can be supplied on request. (Industrial Products Finder. 5(12); 1977; 9)

175 Automatic pH-controller

The Indian Institute of Petroleum, Dehradun has developed a pH controller with a set point control accuracy of 0.01 pH.

The pH measurement is separate from the controller unit and any good quality indigenously made pH meter can be coupled with the controller unit.

The technical specifications are as under:

Range	:	0-14 pH
Set point accuracy	:	0.01 pH
Control action	:	Single point ON/OFF
Control rating	:	NO/NC contacts of rating 3A and 230V

(Technology Awareness Service. 3(2); 1977; 39)

176 Aflatoxin detection meter

This instrument determines concentrations of aflatoxin to one part per billion. A new, built-in safety feature eliminates the possibility of an erroneous reading caused by a lamp malfunction.

The units have a fiber-optic light guide that allow the operator to check the lamp on condition from the front panel. The fiber optic accepts a portion of the light generated by the lamp and

brings it to the front panel for display. In this manner, any zero condition of the sample is assured a true test result. (Food Engineering International. 2(9); 1977; 84)

177 Analysing protein, oil and moisture

The Infra-Alyzer by Technicon Instruments Company Limited, is described as a new breed of automated analytical machine. It is designed to be used by operators to obtain protein, oil and moisture data of grain. It combines the use of multiple wavelength infrared reflectance measurements with sophisticated data handling techniques. This makes possible the analysis of grain or process materials by unskilled operators at a speed and precision previously impossible. (Food Processing Industry. 47(554); 1978; 47)

178 Instrument monitors CO₂ concentration

Based on a new principle without the use of chemicals or reagents, this instrument continuously and automatically monitors CO₂ concentration levels to ensure maximum safety in areas near brewery fermentation vessels or bulk CO₂ storage vessels.

The CO₂ gas detection is capable of remote sampling and is fully equipped with internal and external alarm contacts. (Food Engineering International. 2(12); 1977; 53)

179 Electronic balance is accurate to 0.01 mg

Particularly suitable for weighing-in ingredients, this analytical balance with plug-in electronic circuitry, digital readout and BCD-output as

standard, is available with a reading accuracy of 0.1 or 0.01 mg over the 160 g weighing range.

Both models can be tared over the entire range by simply touching a button. This immediately resets the display to zero. The BCD output can be used for connection to a printer for recording weighed-in ingredients of a compound. The balance can also be connected to a programmable desk-top computer enabling weighing data to be processed together with other measured values derived from photometers, gas chromatographs and similar instruments. (Food Engineering International. 2(12); 1977; 60)

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* ECONOMIC & COMMERCIAL *
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180 Area and production of Oilseeds in India

Oilseeds	Area		Production	
	(Thousand Hectares)		(Thousand Tonnes)	
	1975-76 (Revised)	1976-77 (Final)	1975-76 (Revised)	1976-77 (Final)
Groundnuts				
(Nuts in Shell)	7222	6948	6755	5262
Sesame seed	2170	2165	479	404
Rape & Mustard	3339	3145	1936	1562
Linseed	2119	1925	598	431
Castor seed	375	487	143	172
Niger seed	615	552	151	110
Safflower seed	674	668	238	217

(Oils and Oilseeds Journal. 30(2); 1977; 46)

181 Potential for minor oilseeds and their oils

In normal years, the per capita availability of edible oil in the country averages 3.5 kgs and about 1 kg of Vanaspati, i.e. about 4.5 to 5 kgs as against 25 to 30 kg in several Western Countries. The total requirement of vegetable oils in the country, as of today, is estimated to be around 40-lakh tonnes, against the present availability of only 30-lakh tonnes.

Salseed: It is estimated that the total potential of salseed, particularly in Orissa, Madhya Pradesh, Uttar Pradesh, Bihar and West Bengal, can be around 60-lakh tonnes a year. Its collection is still hardly 1.2 lakh tonnes a year.

Mango kernel: The total potential is about 20-lakh tonnes a year, but its collection now is hardly 10,000-tonnes a year.

The percentage of oil in Salseed and Mango Kernel is 13 and 6 respectively. The total value addition out of all the minor oilseeds processing in the country can be indicated as follows:

Sal fat/oil	...	Rs. 320 Crores
Sal cakes/meals	...	Rs. 40 "
Mango oil	...	Rs. 75 "
Mango cakes/meals	...	Rs. 45 "
Neemseed oil	...	Rs. 130 "
Neemseed cakes/meals	...	Rs. 11 "
Other minor oils	...	Rs. 400 "
Other minor oil cakes/meals	...	Rs. 80 "
Total		Rs.1061 Crores

(The Economic Times. 17(307); 1978; 5)

182 Estimated production of oils and oilcakes in India

(Quantity in thousand tonnes)

<u>OILS</u>	<u>1974-75</u>	<u>1975-76</u>
Groundnut	1157	1620
Rape & Mustard	715	618
Sesamum	119	141
Linseed	170	188
Castor	73	52
<u>OILCAKES</u>		
Groundnut	1736	2431
Rape & Mustard	1431	1235
Sesamum	178	212
Linseed	339	375
Castor	124	89

[Source: Directorate of Economics & Statistics,
Government of India, New Delhi]

(The Oils and Oilseeds Journal. 30(2); 1977; 48)

183 Indian production and exports of Rice bran extractions

Year	Production	Exports		Domestic
	Quantity (Tonnes)	Quantity (Tonnes)	Value (Rs. Crores)	Consump- tion (Tonnes)
April-March				
1976-77	4,65,000	4,02,160	22.79	63,000

(Oils and Oilseeds Journal. 30(2); 1977; 47)

184 Rice bran processing capacity

State	No. of Units	Daily Capacity Tonnes	Annual Capacity (at 300 days) Tonnes
Andhra Pradesh	30	1,375	4,12,500
Assam	2	40	12,000
Bihar	4	145	43,500
Gujarat	4	220	66,000
Goa	1	20	6,000
Haryana	3	125	37,500
Karnataka	9	345	1,03,500
Kerala	1	50	15,000
Maharashtra	13	1,195	3,58,500
✓ Madhya Pradesh	9	505	1,51,500
Orissa	2	35	10,500
Punjab	7	285	85,500
Rajasthan	1	40	12,000
Tamil Nadu	4	185	55,500
Uttar Pradesh	8	365	1,09,500
West Bengal	5	230	69,000
	103	5,160	15,48,000

(Statistics based on the capacities of the members of the Solvent Extractors' Association of India)

(Oils and Oilseeds Journal. 30(2); 1977; 49)

185 Refining losses of rice bran oil by Alkalie

<u>F.F.A. in Oil%</u>	<u>Refining Loss%</u>
3.0	16.1
3.1	13.6
4.9	20.5
6.3	23.5
2.0	12.0
2.1	16.8
2.9	13.5
5.5	44.1
6.6	50.9
17.4	61.6

(Oils and Oilseeds Journal. 30(2); 1977; 48)

186 Solvent extraction units in India

State	No. of Solvent Extraction Units	Daily Capacity Tonnes	Annual Capacity Tonnes
Andhra Pradesh	40	2,850	8,55,000
Assam	2	775	22,500
Bihar	5	240	72,000
Gujarat	43	4,840	14,52,000
Goa	1	24	7,200
Haryana	5	295	88,500
Karnataka	14	810	2,43,000
Kerala	2	110	33,000
Maharashtra	23	2,815	8,44,500
✓ Madhya Pradesh	14	1,165	3,49,500
Orissa	5	218	65,400
Punjab	10	590	1,77,000
Rajasthan	2	110	33,000
Tamil Nadu	7	405	1,21,500
Uttar Pradesh	15	1,060	3,18,000
West Bengal	5	365	1,09,500
Total:	193	15,972	47,91,600

(Oils and Oilseeds Journal. 30(2); 1977; 49)

187 Solvent extraction plants producing Soyabean Oil

Gujarat

1. M/s. Jayant Extraction Industries, Bedeshwar, Jamnagar
2. M/s. Paushak Ltd., C/O P.O. Chemical Industries, Baroda
3. M/s. Synbiotics Ltd., Wadi Wade, Baroda
4. M/s. Soyabean Extractions Pvt.Ltd., Plot No.124, G.I.D.C. Estate, Vithal Udyognagar

Madhya Pradesh

- ✓ 5. Shree Mansingha Oil Mills Pvt.Ltd., Khandwa
- ✓ 6. M/s. Malwa Vanaspati & Chemical Co.Ltd., Mohatta Nagar, Indore

- ✓ 7. M/s. General Foods Pvt.Ltd., Dhabli Village, Opp. Mangligaon Railway Station., Agra-Bombay Road, Indore
- ✓ 8. Shree Krishna Oil Mills, Bombay-Agra Road, Indore
- 11 9. M/s. Vippy Solvex Products Pvt.Ltd., 28, Industrial Area, A.B., Road, Dewas
10. Jagmanak Solvent Extraction Plant, Prop. Bhopal Sugar Industries, Sehore

Maharashtra

11. M/s. Berar Oil Industries, Vanasdapaeth, Akola
12. M/s. Kamani Oil Mills, Chandivali Estate, Saki Vihar Road, Sakinaka, Bombay
13. M/s. Jaihind Oil Mills Co., 153, Bombay-Agra Road, Bhandup
14. M/s. Mansingka Industries Ltd., Pachora
15. M/s. Vegetable Vitamins Co.Pvt.Ltd., Plot No.109, Sion, Bombay
16. M/s. New India Oil Mills Ltd., 387/389, Narsi Natha Street, Bombay
17. M/s. Hanuman Vitamin Foods Pvt.Ltd., Akola Road, Khamgaon

Uttar Pradesh

18. M/s. Prag Ice and Oil Mills, Barafkhana, Aligarh

188 Protein-based foods produced annually in India¹

	<u>Quantity Tons/Year</u>
Milk powder	20,000
Infant and Babyfoods	18,000
Weaning foods	1,000
Beverage powders	12,000
(malted milk, cocoa, ² etc)	
Protein-rich powders	2,000
Bal ahar ²	15,000
Biscuits	700
(enriched with protein and vitamins)	
Bread	45,000
(enriched with protein and vitamins)	
Extrude foods	2,000
"Pharmaceutical" foods	300

¹Source: "Protein Foods & Nutrition Development Association of India" Newsletter, No.23, 1975

²Largely for use in feeding programs

(Food Engineering International. 2(9); 1977; 42)

189 Ice cream production

At present, India is the third largest ice cream producer after the USA and Japan. It produces 333 million litres of ice cream per annum (USA produces 4,542 million litres and Japan 585 million litres), but it has also one of the lowest per capita consumption rates - 0.6 litres per annum whereas, it is 23 litres in USA and 5.7 litres in Japan. (Deccan Herald. 31(94); 1978; 3)

190 Rising demand for meat preparations

Foreign exchange earning from meat and meat preparations of India has been nearly doubled to fetch Rs.103 million in 1975-76 from Rs.52.50 million in 1974-75. India's meat of sheep and goat proved popular in Dubai, Abu Dhabi, Bahrein Islands and Muscat.

Besides meat and meat preparations, Indian supplies of live poultry and sheep, lambs and goats were also considerable in 1975-76. The export trade in live poultry touched Rs.0.24 million while that of the rest was in the neighbourhood of Rs.2.47 million.

The fish exports in 1975-76 were of the order of 52,300 tonnes at an export value of Rs.1265.60 million in 1975-76 and 38,900 tonnes at Rs.662 million in 1974-75. (Economic and Commercial News. 6(33); 1976; 3-4)

191 Synthetics growth seen as warning

According to the World Agricultural Report, the market for textured vegetable protein is expanding rapidly. It is estimated that the production of textured vegetable proteins in Britain alone last year was between 20,000 and 25,000 tonnes. (Food Technology in Australia. 29(11); 1977; 447)

192 Lobster tail export

During 1976, India exported 513 tonnes of lobster tails valued at Rs.31.8 million as against 402 tonnes and Rs.15.8 million during 1975. (Economic and Commercial News. 7(43); 1977; 6)

193 State-wise production of Mangoes

State	Area (000 Hectares)	Production (000 M.T.)
Andhra Pradesh	134	1694.3
Assam	3	25.2
Bihar	125	1153.6
Gujarat	22	220.1
Haryana	4	33.6
Karnataka	28	243.6
Kerala	58	486.7
✓ Madhya Pradesh	24	201.4
Maharashtra	13	130.5
Orissa	58	559.8
Punjab	3	25.1
Tamil Nadu	33	371.2
Uttar Pradesh	390	2987.0
West Bengal	68	975.7
Others	14	117.5
Total:	977	8925.3

Source: Fruit Research Workshop, Hyderabad,
May 1976

(PROFODCIL Bulletin. 12(1&2); 1977; 17)

194 India's exports of Mangoes

Qty: Tonnes		Val: Rs.in lakhs	
Year	Total	Middle East	Western Europe
	Qty. Value	Qty. Value	Qty. Value
1974-75	1619 68.35	1425 58.33	160 8.57
1975-76	3906 161.41	3547 143.19	252 13.50

Source: D.G.C.I.S.

(PROFODCIL Bulletin. 12(1&2); 1977; 18)

195 Pineapple processing in India

The current production of pineapple products in the country is between 5,500 and 6,000 tonnes. The percentage share of different items of production are:

Pineapple slices	36 to 38
Pineapple juice	41 to 42
Pineapple jam	5 to 42
Pineapple pulp	6 to 8
Pineapple squash	3
Others	3

(PROFODCIL Bulletin. 12(1&2); 1977; 3)

196 India's export of Pineapple products during 1975-76

Qty: Tonnes		Val: Rs. '000	
Products	Qty.	Value	
Pineapple juice	152.0	486.6	
Pineapple slices	1122.0	5631.0	
Pineapple pulp	53.8	226.0	

(PROFODCIL Bulletin. 12(1&2); 1977; 4)

197 Export of processed foods

Quantity: Tonnes
Value: Rs. Lakhs

Item	Mar. 76-Apr. 77		Mar. 75-Apr. 76	
	Qty.	Value	Qty.	Value
Fruits and vegetable products	23518	1316.32	14149	758.52
Meat, Poultry products and animal casings	12553	1355.09	5885	743.29
Biscuits and confectionery	4318	335.33	2399	187.41
Guargum and guar-meal	65209	1570.32	26891	1135.05
Wheat bran	11810	95.33	7564	67.12
Milk and milk products	657	73.94	86	12.67
Starch and derivatives	3472	47.34	2978	43.28
Papads	1527	101.61	938	65.17
Instant coffee	-	6.90	577	318.36
Instant tea	657	301.14	483	193.61
Walnuts	6646	727.00	4003	323.92
Fresh fruits and vegetables	227547	3105.30	156256	2166.97
Others	-	416.65	-	240.34
Total:	-	9452.27	-	6254.81

(The Chemical & Polymer Times. 4(10); 1977; 5)

198 India's group-wise Exports(Value in Rs. Million)
(Quantity in Tonnes)

		Apr.1976 to Mar.1977	
No.	Commodity	Quantity	Value
A.	<u>Agriculture & Allied</u>		
	<u>Products</u>	-	10844.5
1.	Oilseed and nuts and kernels	-	711.6
	(a) Groundnut	136.5	652.4
2.	Vegetable oil (non-essential)	95.3	485.8
	(a) Castor oil	41.0	220.2
	(b) Groundnut	3.4	19.7
	(c) Other residual	50.9	245.9
3.	Oilcake	1727.0	2238.1
4.	Spices	55.3	729.2
	(a) Pepper	20.5	382.4
	(b) Cardamom	0.9	130.5
	(c) Ginger	4.5	58.4
	(d) Chillies	3.1	27.2
	(e) Turmeric	11.8	44.4
	(f) Others	14.5	86.3
5.	Sugar	580.0	1481.2
6.	Fruits and vegetables and pulses	-	1606.2
	(a) Cashew kernels	51.6	1059.9
	(b) Banana	0.7	1.3
	(c) Pulses	8.1	23.8
	(d) Onion	163.5	188.5
	(e) Other fruits and vegetables	-	332.7
7.	Gums, Resins and Balsam	8.1	69.7
8.	Meat and meat preparations	-	178.8
9.	Animal casings	-	29.5
10.	Rice	20.8	61.2
11.	Fish	58.8	1802.5
B.	<u>Plantation</u>	-	4069.2
12.	Tea and mate (Mill.Kg)	243.2	2928.7
13.	Coffee	47.5	1140.5

(Economic and Commercial News. 7(45); 1977; 6)

199 IDA credit for fruits-scheme

The IDA has decided on a credit of \$14 m. for the project designed to improve the marketing and production of apples, walnuts, and a small research component for mushroom development in J&K State. In J&K State, there are about 500 farmers producing 95 tonnes of mushroom. Walnut production in the state is estimated at 23,000 tonnes a year. (Economic Times. 23-5-78)

200 Cardamom

The production of cardamom during 1977-78 was about 3,800 tonnes. (Economic Times. 18(71); 1978; 3)

201 Comparative statement of estimated requirements of Alcohol by 1981

	(In lakh litres)	
	D.G.T.D. -Ferment- ation Pan- el-Estima- tes 1981	AABIDA Estimates (180/81)
1. Synthetics Rubber	77.00	960.00
2. Plastic Group		
PVC	400.00	250.00
LDP	800.00	450.00
3. Organic Chemicals Acid etc. (including Acetate Rayon Yarn)		
(ii) Butanol		
(iii) Butyl Acetate		
(iv) Cellulose Acetate		
(v) Styrene	750.00	
4. Pesticides or D.D. T.	60.00	Items (3-4-5)
5. Pharmaceuticals	160.00	1740.00
	2940.00	3400.00

contd...

	2940.00	3400.00
6. paints and Varnishes		
[French Polish]	400.00	400.00
7. Hospitals	400.00	400.00
8. Miscellaneous	900.00	1000.00
	4640.00	5200.00
Provision for New Licenses already issued for industrial use	-	740.00
	4640.00	1800.00
Non-Industrial Potable use	1800.00	5940.00
TOTAL	6440.00	7740.00

[Source: AABIDA Memorandum]
(Indian Chemical Journal. 12(6); 1977; 40)

202 Statewise estimates of Molasses and Alcohol

Name of the State	Molasses (Lakh tonnes)		Alcohol (Million litres)	
	1976-77	1983-84	1976-77	1983-84
1. U. P.	6.30	7.13	140.0	156.00
2. Bihar	1.00	1.44	19.5	31.68
3. Punjab	0.22	0.47	3.96	8.50
4. Haryana	0.55	0.70	11.5	15.40
5. Maharashtra	5.50	8.23	110.0	181.00
6. Gujarat	0.91	1.81	13.5	30.00
7. Tamil Nadu	1.65	2.84	30.50	62.48
8. Andhra Pradesh	1.92	2.76	44.85	68.00
9. Karnataka	1.67	3.05	32.0	67.10
	19.72	28.43	405.81	620.16

[Source: Ministry of Chemicals & Fertilizers]
(Indian Chemical Journal. 12(6); 1977; 39)

203 Area under hop

Area under Hop has been extended to 7.5 ha in Kashmir in the current year as against 4.5 ha during 76-77. (CIMPO Newsletter. 4(4); 1977; 2)

204 Glass bottle production

Glass bottles required for packing of drugs and pharmaceuticals, milk, brewery, distillery and soft drinks, are manufactured by 21 units with an installed capacity of 278,600 tonnes per annum. In 1975, actual output of glass bottles was 205,000 tonnes. There are no imports of glass bottles into India. (Economic and Commercial News. 6(33); 1976; 3)

205 Excise duty concession on metal containers

The Government of India have decided to exempt Metal Containers of capacity not exceeding one kilogram or one litre manufactured without the aid of power from sheets which had been tinned printed, coated or lacquered by others with the aid of power from the whole of duty of excise leviable thereon. (Spices Newsletter. 12(3); 1978; 2)

206 Export credit

The Reserve Bank of India has intimated vide its Circular No.DBOD.ECC.BC.144/C. 297P./77 dated December 20, 1977 that the "cargo/freight/marine containers which conform to I.S.O.Standard" are eligible for: (i) pre-shipment credit at the ceiling rate of interest of 11.5 percent per annum for a maximum period of 180 days in the first instance and

to 2.3%. (Food Engineering. 2(10); 1977; 21)

209 Nutrition labelling

The U.S. Food & Drug Administration may soon unveil a proposal requiring sodium and potassium content declarations on all nutrition labels. The agency also is considering regulatory controls to voluntarily increase cholesterol and fatty acid labeling. (Food in Canada. 37(12); 1977; 40)

210 FDA bans use of acrylonitrile in plastic beverage bottles

FDA has issued a final decision stating that "acrylonitrile copolymers used to fabricate beverage bottles are food additives and they have not been shown to be safe". Effective December 22, 1977, acrylonitrile (AN) may no longer be used in beverage bottles. (Food Product Development. 11(9); 1977; 82)

211 FDA rejects miracle fruit product as sweetening ingredient

The FDA has rejected a petition for the use in the United States of a sweetener made from miracle fruit. The sweetener, made from berries of the miracle fruit tree, is a low calorie protein which when eaten makes most sour food taste sweet. Miracle fruit berries are reported to have been in use in West Africa for hundreds of years. The FDA has carefully reviewed all data and finds on the basis of ~~these~~ data it cannot assure the safety of either general or limited use of miracle fruit and its products for use in foods. (Food Production Management. 100(1); 1977; 23)

Precooked beef roasts must be cooked to an internal temperature of 145°F under an immediately effective regulation issued September 2 by USDA. Rare roast beef is commonly cooked to internal temperatures less than 130° and can carry live salmonella. The requirement to roast to 145° will preclude production of rare beef. The American Meat Institute asked USDA to revise the minimum temperature to 135 or 139°, so rare precooked beef can be marketed.

During the past three years several outbreaks of salmonellosis have been associated with precooked roasts of beef, according to Morbidity and Mortality Weekly Report from the Center for Disease Control (CDC). Collaborative study of the most recent outbreak by CDC and the state health departments of New York, New Jersey, Connecticut, and Pennsylvania clearly established the connection between the disease and unopened, precooked roasts. Earlier reports had implicated roasts injected with spice mixture, and the 145° internal temperature had been required for injected meat.

Salmonella theoretically may reach the interior of roasts through deboning, massaging, folding, or flow of juices during processing. The contaminated roasts were made from Australian beef, but a USDA official stated the blame should not rest on imported beef, as salmonella is no more of a problem with imported than with domestic beef. (Food Product Development. 11(8); 1977; 20)

213 Is zinc the key to disease resistance?

Studies at Michigan State University indicate zinc may be necessary for development of effective disease resistance in higher animals and possibly man. Mice fed zinc-deficient diets suffered thymus gland damage. This organ is responsible for immune cell production.

Animal study results correlate with the health problems of underdeveloped nations. In Africa, and South America, death rates are abnormally high from diseases such as mumps, measles, and **chicken pox**. People may be suffering from deficient immune systems, and the underlying reason for disease susceptibility lies in the vegetarian diet. Plants contain phytic acid which binds zinc making it unavailable for bodily use. This could affect the thymus gland and, in turn, the immune system. (Food Product Development. 12(1); 1978; 64)

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* TRANSFER OF TECHNOLOGY *
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214 Maize products

The Central Government has given a letter of intent to the Andhra Pradesh Agro-Industries Corporation for setting up a unit in Nizamabad district to manufacture maize products.

The unit will have an annual capacity of 15,000 tonnes for manufacturing maize products such as brewer's grit, fine meal, semolina, flour,

animal meal, bran and corn oil, and another 5000-tonne capacity to produce corn flakes. (Industrial Development News. 12(7); 1977; 105)

215 Oil complex

A Rs. 75-lakh sunflower, groundnut and cotton-seed oil complex has gone on stream near Coimbatore. It has a daily crushing capacity of 50-tonnes of groundnut oil and 14-tonnes of sunflower and cotton-seed oil per day.

The project has a seed-pre-processing unit, oil milling unit, solvent extraction unit, a refinery and a boiler house. (Industrial Development News. 12(7); 1977; 110)

216 New fruit processing complex

The National Agricultural Co-operative Marketing Federation Ltd. (MARKFED) in collaboration with German Democratic Republic (GDR) will set up a Rs.6 Crore fruit processing unit in the North Eastern Region. The plant will process 1,30,000 tonnes of pineapples, oranges, tomatoes and other fruits worth Rs.15 Crore annually. These would be exported to GDR on a long-term basis. The plant will serve both in improving the standard of living of the farmers in the region and ensure continuous supply of high quality raw materials for processing. (The Chemical and Polymer Times. 4(10); 1977; 3)

217 Vitamin A unit in Kerala

Kerala State Drugs & Pharmaceuticals Ltd., a Government of Kerala Undertaking, is implementing a project for the manufacture of Vitamin A from lemon

grass oil. The Rs.5 Crore project is expected to be commissioned by 1980. It will turn out 30 million mega units of Vitamin A per year. (The Chemical & Polymer Times. 4(10); 1977; 3)

218 Caffeine from tea waste

M/s. Assam Pharma Co., Jorhat-8 (Assam) have successfully established commercial production of caffeine on their 30-tonne per annum capacity plant. The process knowhow and other technical assistance required in the implementation of the project were provided by the Regional Research Laboratory, Jorhat.

The present requirement of caffeine in the country is estimated at more than 100 tonnes per annum. Four units are reported to be producing caffeine in India. The main raw-material required in the process developed by RRL, Jorhat for caffeine manufacture is tea waste, which constitutes sweepings of fluff, tea prunings, stalks and leaves accumulated in the tea processing factories. It is reported that nearly 10 million kg of tea waste is available annually.

The process basically consists in (i) extraction of tea waste with lime liquor to bring caffeine into the aqueous phase, (ii) extraction of the aqueous solution with benzene by counter-current liquid-liquid extraction to extract caffeine into the solvent phase, and (iii) distillation for recovery of benzene and crystallisation of caffeine from water. (Technology Awareness Service. 3(1); 1977; 11)

219 Industrial licences

Indian Farmers Fertilizers Co-operative Ltd.,
34, Nehru Place, New Delhi-110 024 (Mehsana-
Gujarat)
Malathion Technical-500 tonnes (N.A)

Kaira District Co-operative Milk Producers Union
Ltd., Amul Dairy Road, Anand-388 001 (Gujarat)
1. Cheese-125 TPA (addl.)-2000 TPA (after expansion)
2. Ghee (byproduct)-1400 TPA (addl.)-2000 TPA (after expansion)
3. Butter (byproduct)-2000 TPA (addl.)-5000 TPA (after expansion) (S.E)

Bangalore Animal Food Corpn.Ltd.,
Victoria Road, Bangalore-560 007 (Karnataka)
1. Sheep/Goat-9 lakhs nos. 2. Cattle-6,000 nos.
(including Blood meal, bone meal, Tallow etc.,
Liver extract and Manure-by products). (N.U)

NU: New Unit

NA: New Article

SE: Substantial Expansion

COB: Carry on Business and Shifting

(Financial Express. 18(105); 1978; 3)

220 Technologies released

<u>Process/Lab.</u>	<u>Party</u>	<u>Terms</u>
*Caffeine from tea waste (RRL, Jorhat)	Gromor Pesticides Pvt.Ltd., Calcutta (May 77)	P: Rs.5,000 R: 2½% NE for 10 yrs
*Calcium gluconate (CECRI)	Sri Asif Vazirally, Madras (May 77)	P: Rs.5,000 R: 2% NE for 14 yrs
**Maleic hydrazide (NCL)	Micro Chemicals (India) Mandasaur (Nov.76)	P: Rs.10,000 R: 1% NE for 7 yrs
✓ **Papain, crystalline and papain concentrate (RRL, Hyderabad)	Rajesh Industrial Corporation, Kamptee (Nov.76)	P: Rs.5,000 R: 2½% NE for 14 yrs
**Protein hydrolysate (CDRI)	Aristo Pharmaceuticals Pvt.Ltd, Bombay (Nov.76)	Rs. 1,000 (Technical aid)

P: Lumpsum Premium; R: Recurring Royalty;
NE: Non-exclusive

(*Research & Industry. 22(3); 1977; 205)

(**Technology Awareness Service. 3(1); 1977; 12-14)

221 Sorghum-millet data center

Canada's International Development Research Center is funding the new Sorghum and Millet Information Center, which will become a part of the International Crops Research Institute for the Semi-Arid Tropics in Hyderabad, India. The new Center will be operational by the end of this year. The Center seeks to provide, in both French and English, recent and accurate information on sorghum and millet via a newsletter and updated bibliographies. It also will be able to handle specific subject searches and offer a question and answer service. (Agricultural Engineering. 58(11); 1977; 40)

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